**Tech Lunch**
**Flexibility Quantification in Households - Case study in Valais**

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## DEEP Projects

SmartHelio
YOUR DATA ANALYTICS PARTNER

- Fault identification
- Advanced analytics for PV Array
- Improved forecast

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- Data analytics for local energy markets
- LEM under PV penetration

- 'Insights Marketplace' - growing library of valuable models
- Market has models (e.g., load forecasting, anomaly detection) from research projects / leading researchers.

## Project Overview: GOFLEX at a high level

- Enabling active use of distributed sources of load flexibility to

  - provide services for grid operators,

  - balance electricity demand and supply, and optimize energy consumption and production

- Project Duration: 36 months

- Use Cases in Cyprus, **Switzerland**, and Germany

## Swiss demonstration site 1/2



Municipality of Sion (Valais), Switzerland

- Key figures:

- OIKEN: Energy supplier to over 90'000 clients.
- Sion area: 900 PV producers, numerous small-medium Enterprises (SMEs), an airport, swimming pools, a skating rink, a hospital, a rehabilitation center, and a lot of other big electricity consumers.
- Valais: 2200 electric vehicles registered in Valais, numerous renewable power plants exist such as small hydro, biomass, etc.
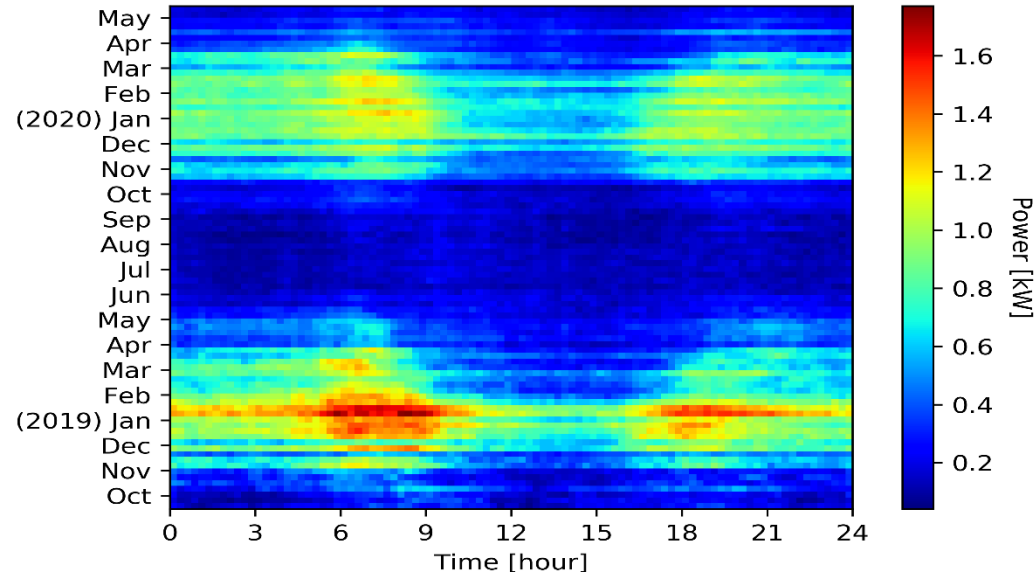
# Swiss demonstration site 2/2
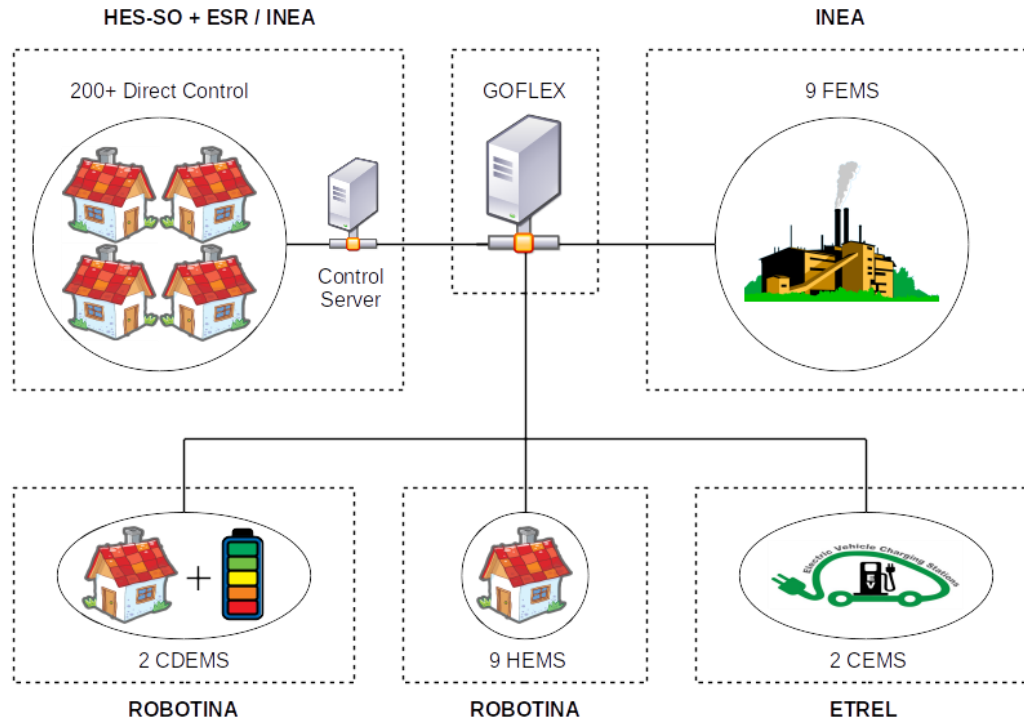
# Flexibility quantification in households:
# Available energy : Heating appliances
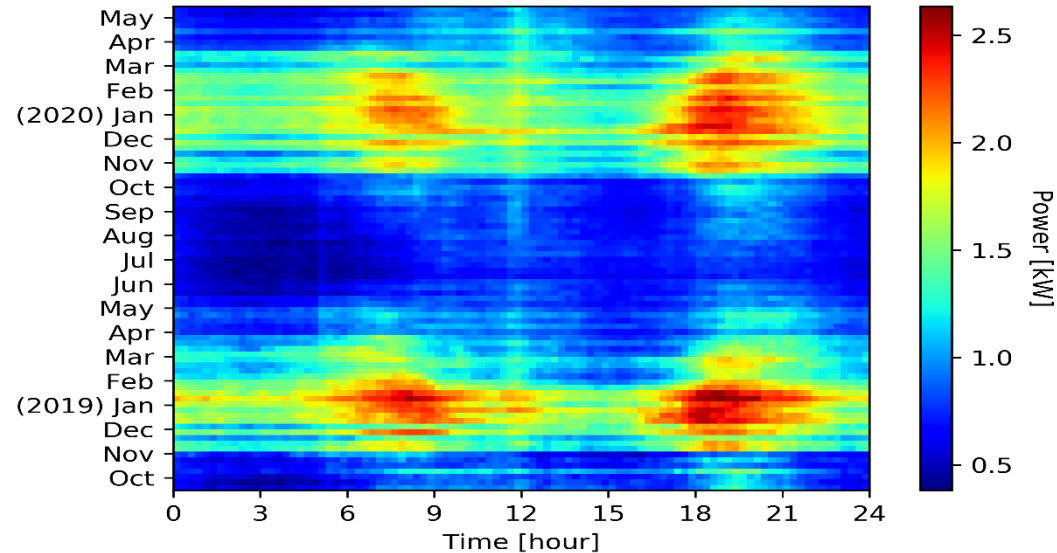


Two major peaks of consumption in the morning and afternoon with household activities (morning/evening showers, heating)

# Flexibility quantification in households:
## Available energy : Space heating



- The daily average temperatures range from -4◦C in January to 27◦C in July.
- During the heating season, the heating systems are used to keep the room temperature at around 22◦C. The period depends heavily on the location of the buildings, but usually lasts from September to May.

# Flexibility quantification in households:
# Available energy: Hot Water
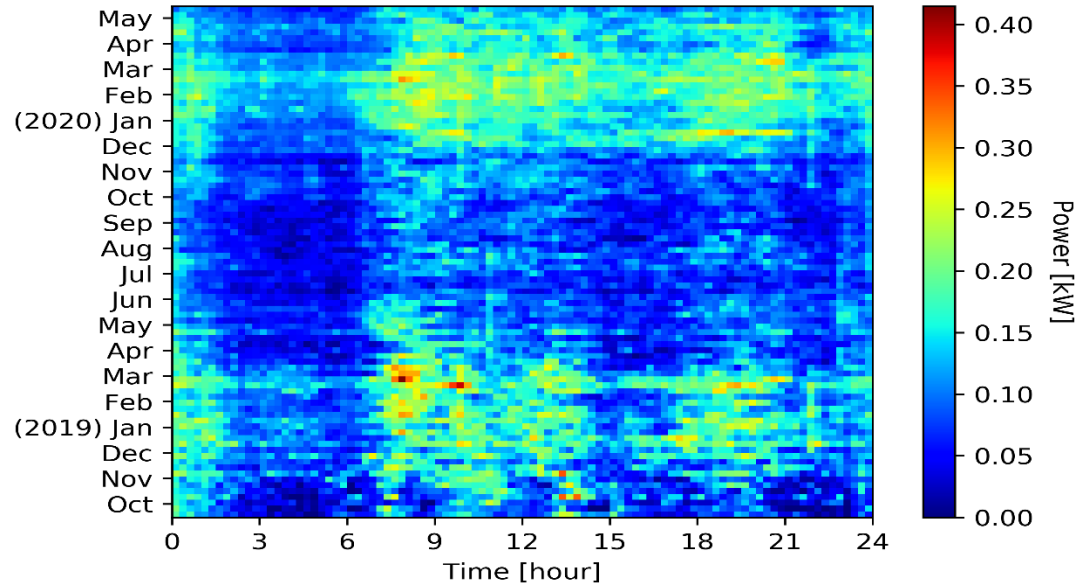


-The power required for hot water supply follows the hot water requirement.
-During the spring season of 2020, there is an increase in terms of consumption compared to the same period during the previous year, which could be explained by the Covid-19 health crisis.

# Flexibility quantification in households:
# Available energy: Heating versus temperature
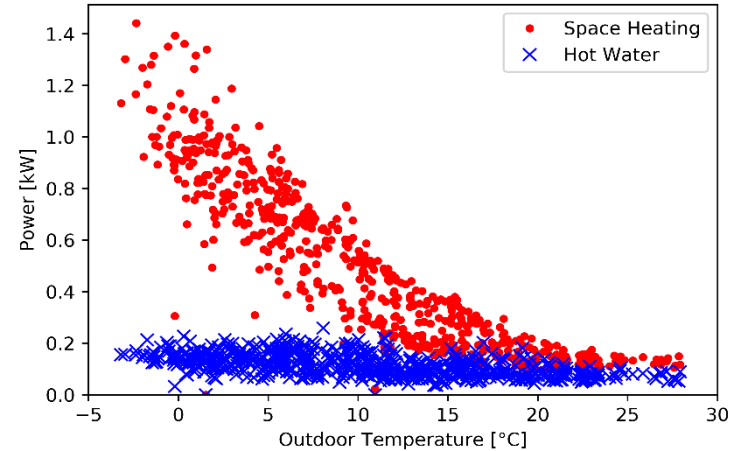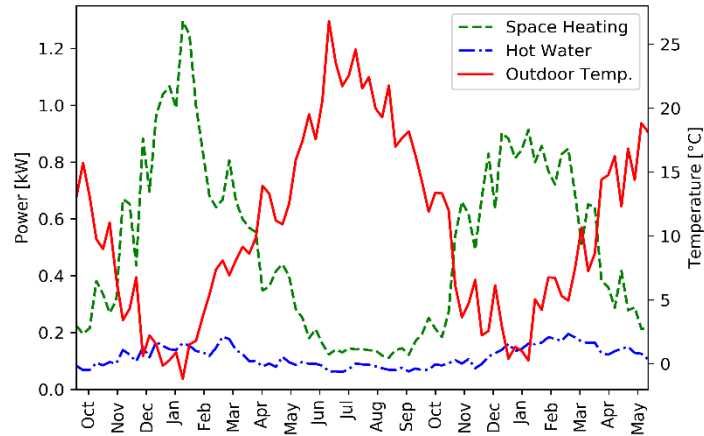


- Space heating appliances show their maximum consumption between December and February but are mostly switched off between May and October.
- A slight decrease of hot water power with increasing outdoor temperature mentioned above. This could be explained by the fact that the cold water entering the system is colder in winter than in summer and therefore requires more energy to be heated up.

## Flexibility quantification in households:
## Available energy: pooling effect on prediction
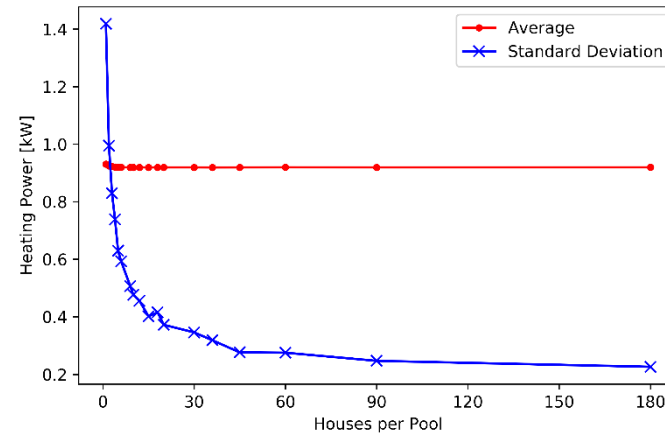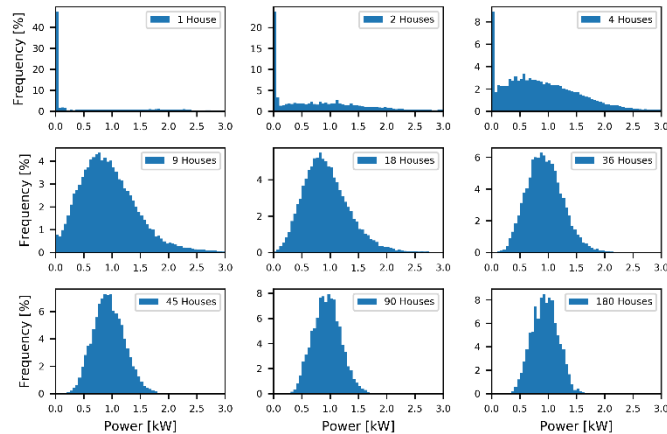


- The prediction of the consumption of a large pool of households will be more accurate than the prediction of the consumption of a single household. Considering pools of a sufficient number of households rather than individual households also guarantees that a minimum level of power is consumed at any given time.
- A minimum of 45 houses is needed in this case to have good quality estimation.

## Flexibility quantification in households:
## Shifting potential
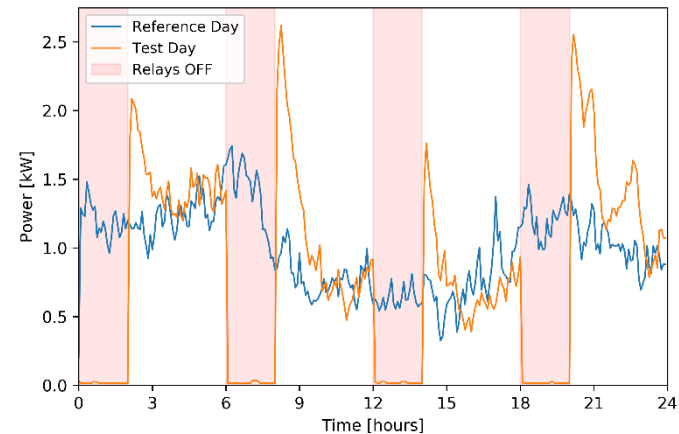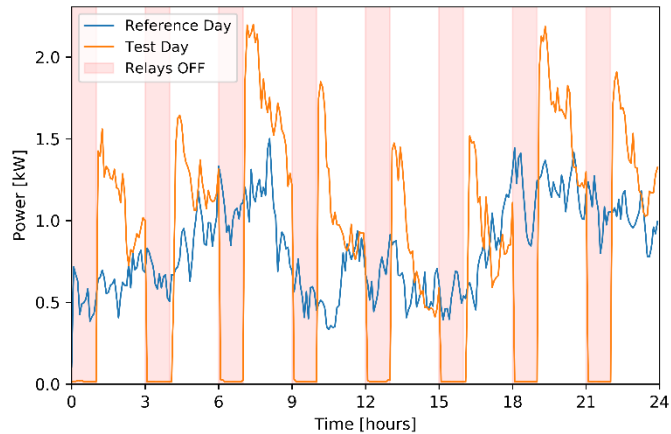


When switched off for one hour, heating appliances tend to consume a lot more than usual in the first following hour, to compensate for the removed energy consumption. These expected rebound phases tend to be higher in early morning and in the evening.

## Discussion

- We evaluated the flexibility potential in households using heating appliances.

- Flexibility potential was predicted using a model based on temperature and is expected to include more weather parameters in order to have more accurate results.

- The effect of pooling households on the accuracy flexibility prediction was also demonstrated.

- Cut tests showed the possibility to shift heating consumption without altering the comfort of consumers.

- This was demonstrated via real time control tests over a bundle of houses and simulated results for more optimized control strategies.

- Further research is conducted to validate this new solution and enhance the flexibility prediction models.